18. Briefly discuss the classical theory of Raman effect.

19. Explain three level and four level laser systems.

20. Describe the construction and explain the working of CO_2 laser with the help of an appropriate energy level diagram.

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APRIL/MAY 2025

GOPH25A/DOPH25A — SPECTROSCOPY AND LASERS

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Do the diatomic molecules such as H_2, N_2 show a rotational spectrum? Give reason.

2. List four applications of microwave spectroscopy.

3. Why Morse potential is used to represent vibrations of a diatomic molecule?

4. What are the different modes of vibrations of CO_2 molecule?

5. Compare IR and Raman spectroscopy.

6. What are the factors that affect the intensity of scattered light in Raman scattering?

7. State the principle of laser.

8. Define population inversion.

9. What is the role of He atoms in He-Ne laser?

10. Compare Nd-YAG and CO_2 laser.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) What do you understand by non-rigid rotator? Explain the rotation spectra of non-rigid rotator.

Or

(b) Discuss about the synmietric and asymmetric top molecules.

12. (a) Explain the principle of IR spectroscopy.

Or

(b) Discuss the vibrational spectra of polyatomic molecules.

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13. (a) Explain vibrational Raman spectra of H_2O and CO_2 molecules.

Or

(b) With the help of a schematic diagram explain the working of the Laser Raman spectrometer.

14. (a) Explain the characteristics of laser.

Or

(b) Derive Einstein's coefficient for leasing action.

15. (a) With suitable energy level diagram explain the working of Ruby laser.

Or

(b) Briefly discuss the industrial applications of laser.

SECTION C — ($3 \times 10 = 30$ marks)

Answer any THREE questions.

16. Discuss the rotational spectra of a rigid diatomic molecule.

17. Discuss the principle and instrumentation of FTIR spectrometer.